Pending Claims

The listing of claims will replace all prior versions, and listings of claims in the application.

1. (Original) In a Noise Feedback Coding (NFC) system, a method of searching N predetermined Vector Quantization (VQ) codevectors for a preferred one of the N VQ codevectors to be used in coding a speech or audio signal, comprising the steps of:

(a) predicting the speech signal to derive a residual signal;

(b) deriving a VQ input vector corresponding to a VQ error vector, based on the residual signal and a corresponding one of the N VQ codevectors;

(c) repeating steps (b) for each of the N VQ codevectors to produce N VQ error vectors corresponding to the N VQ codevectors; and

(d) selecting the preferred VQ codevector as a VQ output vector corresponding to the residual signal based on the N VQ error vectors.

2. (Original) The method of claim 1, further comprising the step of:

deriving a VQ error energy value corresponding to each of the N VQ error vectors of step (b), wherein step (d) comprises selecting one of the N VQ codevectors corresponding to a minimum error energy value as the preferred VQ codevector.

3. (Original) The method of claim 1, wherein step (b) comprises the steps of:

(b)(i) combining the VQ input vector and the one of the N VQ codevectors to produce the corresponding VQ error vector;

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(b)(ii) filtering at least a portion of the VQ error vector to produce a noise feedback vector; and

(b)(iii) combining the noise feedback vector and the residual signal to produce the VQ input vector.

4. (Original) The method of claim 3, wherein said filtering step (b)(ii) comprises one of

short-term filtering the VQ error vector, and

long-term filtering the VQ error vector.

5. (Original) The method of claim 3, wherein said filtering step (b)(ii) comprises filtering the VQ error vector based on an initial filter state corresponding to a previous preferred codevector.

6. (Original) The method of claim 5, wherein step (b) further comprises the step of:

(b)(iv) restoring the initial filter state before each pass through filtering step (b)(ii).

7. (Original) The method of claim 1, wherein said predicting step (a) comprises the steps of:

(a)(i)   predicting the speech signal to produce a predicted speech signal; and

(a)(ii) combining the predicted speech signal with the speech signal to produce the residual signal.

8. (Original) The method of claim 1, wherein step (b) comprises the steps of:

(b)(i)   combining the residual signal with a noise feedback vectors to produce a predictive quantizer input vector;

(b)(ii) predicting the predictive quantizer input vector to produce a predicted, predictive quantizer input vector;

(b)(iii) combining the predictive quantizer input vector with the predicted, predictive quantizer input vector to produce the VQ input vector;

(b)(iv) combining the predicted, predictive quantizer input vector with the VQ codevector to produce a predictive quantizer output vector; and

(b)(v)   filtering a VQ error vector corresponding to the predictive quantizer output vector to produce the noise feedback vector.

9. (Original) The method of claim 8, wherein said filtering step (b)(v) comprises one of

short-term filtering the VQ error vector, and

long-term filtering the VQ error vector.

10. (Original) The method of claim 8, wherein:

the predicting in step (b)(ii) is based on an initial predictor state corresponding to a previous preferred codevector; and

the filtering in step (b)(v) is based on an initial filter state corresponding to the previous preferred codevector.

11. (Original) The method of claim 10, wherein step (b) further comprises the

steps of:

restoring the initial predictor state before each pass through step (b)(ii); and

restoring the initial filter state before each pass through step (b)(v).

12. (Original) In a Noise Feedback Coding (NFC) system, a method of

searching N predetermined Vector Quantization (VQ) codevectors for a preferred one of

the N VQ codevectors to be used in coding a speech or audio signal, comprising the steps

of:

(a) predicting the speech signal to derive a residual signal;

(b) deriving N VQ input vectors each based on the residual signal and a

corresponding one of the N VQ codevectors, each of the N VQ input vectors

corresponding to one of N VQ error vectors; and

(c) selecting the preferred one of the N VQ codevectors as a VQ output vector

corresponding to the residual signal, based on the N VQ error vectors.

13. (Original) The method of claim 12, further comprising the step of deriving N

VQ error energy values each corresponding to one of the N VQ error vectors of step (b),

wherein said selecting step (c) comprises selecting one of the N VQ codevectors

corresponding to a minimum one of the N error energy values as the preferred one of the

VQ codevectors.

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14. (Original) A Noise Feedback Coding (NFC) system for searching N Vector

Quantization (VQ) codevectors stored in a VQ codebook for a preferred one of the N VQ

codevectors to be used for coding a speech or audio signal, comprising:

predictor logic adapted to predict the speech signal to derive a residual signal;

an input vector deriver adapted to derive N VQ input vectors each corresponding

to one of N VQ error vectors, based on the residual signal and a corresponding one of the

N VQ codevectors; and

a selector adapted to select the preferred one of the N VQ codevectors as a VQ

output vector corresponding to the residual signal, based on the N VQ error vectors.

15. (Original) The system of claim 14, further comprising an error-energy

calculator to derive N VQ error energy values each corresponding to one of the N VQ

error vectors, the selector being adapted to select one of the N VQ codevectors

corresponding to a minimum one of the N VQ error energy values as the preferred one of

the VQ codevectors.

16. (Original) The system of claim 14, wherein the input vector deriver

includes:

a combiner to separately combine each of the N VQ input vectors with the

corresponding one of the N VQ codevectors to produce the N VQ error vectors

corresponding to the N VQ input vectors;

a filter to separately filter at least a portion of each of the N VQ error vectors to

produce N noise feedback vectors, each corresponding to one of the N VQ codevectors;

and

combining logic adapted to separately combine each of the N noise feedback

vectors with the residual signal to produce the N VQ input vectors.

17. (Original) The system of claim 16, wherein the filter is one of

a short-term filter adapted to short-term filter each of the N VQ error vectors, and

a long-term filter adapted to long-term filter each of the N VQ error vectors.

18. (Original) The system of claim 16, wherein the filter is adapted to filter each

of the N VQ error vectors based on an initial filter state corresponding to a previous

preferred codevector.

19. (Original) The system of claim 18, further comprising a filter restorer

adapted to restore the initial filter state before the filter filters each of the N VQ error

vectors.

20. (Original) The system of claim 14, wherein the predictor logic comprises:

a predictor adapted to predict the speech signal to produce a predicted speech

signal; and

a second combiner adapted to combine the predicted speech signal with the

speech signal to produce the residual signal.

21. (Original) The system of claim 14, wherein the input vector deriver further

comprises:

a first combiner adapted to separately combine the residual signal with each of N

noise feedback vectors to produce N predictive quantizer input vectors;

a predictor adapted to predict each of the N predictive quantizer input vectors to

produce N predicted, predictive quantizer input vectors;

combining logic adapted to separately combine each of the N predictive quantizer

input vectors v with a corresponding one of the N predicted, predictive quantizer input

vectors, to produce the N VQ input vectors;

a second combiner adapted to separately combine each of the N predicted,

predictive quantizer input vectors with a corresponding one of the N VQ codevectors to

produce N predictive quantizer output vectors; and

a filter adapted to separately filter each of the N VQ error vectors corresponding

to each of the N predictive quantizer output vectors to produce the N noise feedback

vectors.

22. (Original) The system of claim 21, wherein the filter is one of

a short-term filter adapted to short-filter each of the N VQ error vectors, and

a long-term filter adapted to long-term filter each of the N VQ error vectors.

23. (Original) The system of claim 21, wherein:

the predictor is adapted to predict each of the N predictive quantizer input vectors

v based on an initial predictor state corresponding to a previous preferred codevector;

and

the filter is adapted to filter each of the N VQ error vectors based on an initial

filter state corresponding to the previous preferred codevector.

24. (Original) The system of claim 23, further comprising:

a predictor restorer adapted to restore the predictor to the initial predictor state before the predictor predicts each of the N predictive quantizer input vectors; and

a filter restorer adapted to restore the second filter to the initial second filter state before the second filter filters each of the N VQ error vectors.